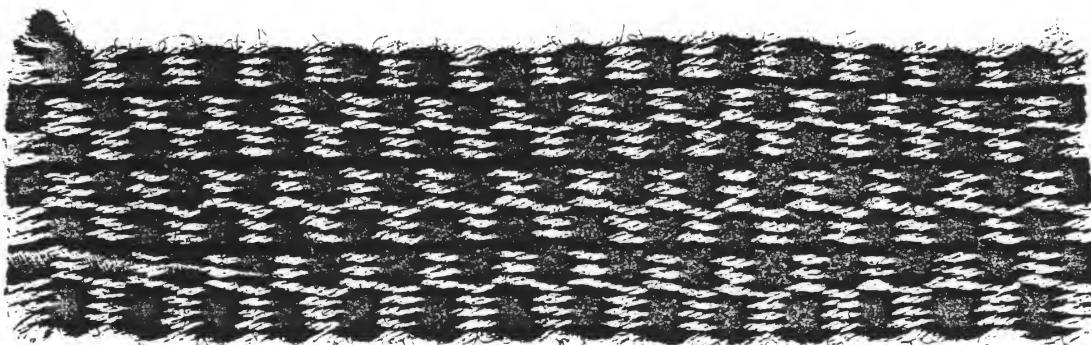


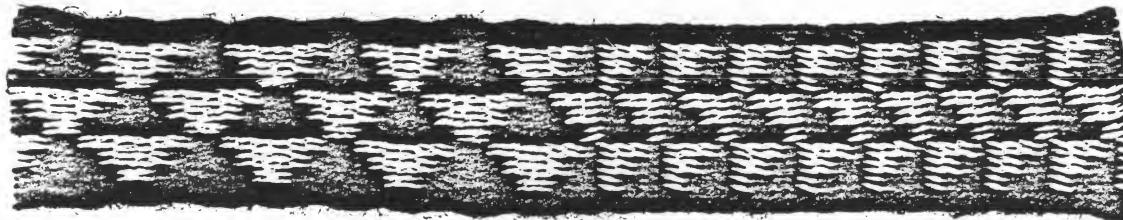
COMPUTER DESIGN

BAND WEAVING



RIGID HEDDLE WEAVING

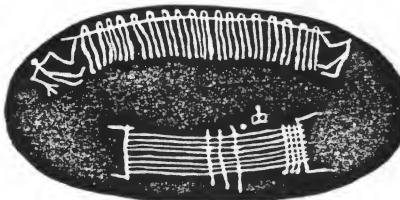
CARD WEAVING



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RIGID HEDDLE WEAVING

Weaving is an extremely old technology. Although very few examples of early cloth have survived because cloth is so fragile, we do know that people have woven since at least as long ago as 4400 B.C. which is the date of the earliest known picture of a loom. It was found on the inside of an Egyptian dish and shows a simple loom that is pegged into the ground. Similar looms are still used in parts of North Africa today.



Although looms now come in many sizes and complexities they are essentially devices that keep a group of threads tense and in the right order. These threads that are wound and stretched on the loom are called warp threads, or more simply, a warp. Weaving consists of interlacing other threads called weft threads over and under the stretched warp threads.

This booklet will show how you can weave on two different kinds of looms and use one of our newest technologies to help design your work. Both looms are so simple that they are really nothing more than tools to keep your threads in order and provide a way to lift certain threads up when you want them. The energy source for keeping the warp threads stretched and tense will be your body.

For the first type of weaving you will try you will use a device called a rigid heddle to control the threads. To weave with a rigid heddle you will have to do the following:

Design Decide what you want your band to look like.
Draw a picture of your design on graph paper or use the computer and obtain a print-out.
Find out how many threads of each color you will need to weave your design.
Decide how long to make your band.

Warping Measure and cut these threads.

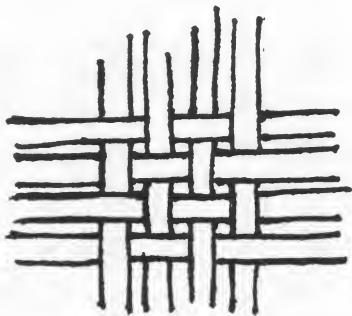
Threading Thread your warp through the rigid heddle holes and slots.

Weaving Weave your band.

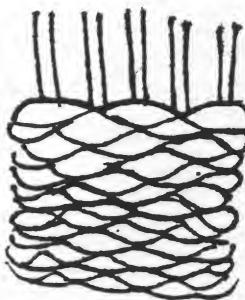
Finishing Finish the ends of the completed band, weave in loose threads.

DESIGNING YOUR BAND

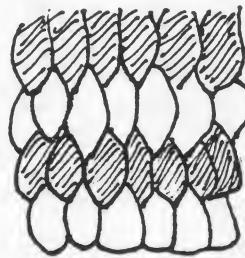
Examine different kinds of cloth and notice how the warp and weft threads interlace. Sometimes the weft threads don't show at all. With other kinds of fabric the warp threads are completely covered by the weft. Other fabrics, the most common ones such as much of your clothing, sheets, curtains and blankets, are woven so that both warp and weft show.



Balanced



Weft-faced



Warp-faced

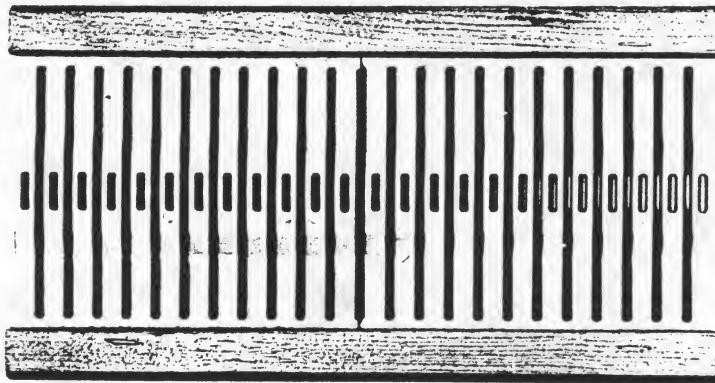
When warp and weft are about equally visible the weave is called a balanced weave. When only the weft threads show we call the weave weft-faced. Tapestries and Oriental carpets are weft-faced. When only the warp threads are visible the weave is called warp-faced. This is the kind of weaving you

will be doing with the rigid heddles. It is possible to do balanced and weft-faced weaving with these heddles too, but the design program you will be exploring deals only with warp-faced structures.

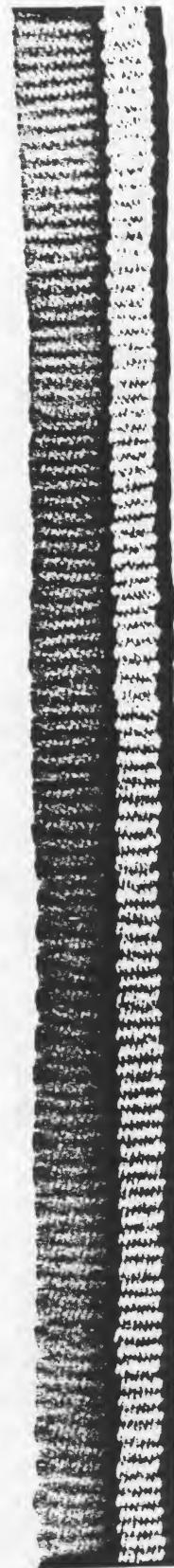
The different patterns you can weave with a rigid heddle depend on the colors you choose and the order in which you arrange them. On the next page you will see examples of stripes, checks, spots and several other designs. You will also find the same patterns on the computer and woven examples on the display board.

For your first band you may simply want to copy one of these designs using your own colors, or you may prefer to design your own pattern.

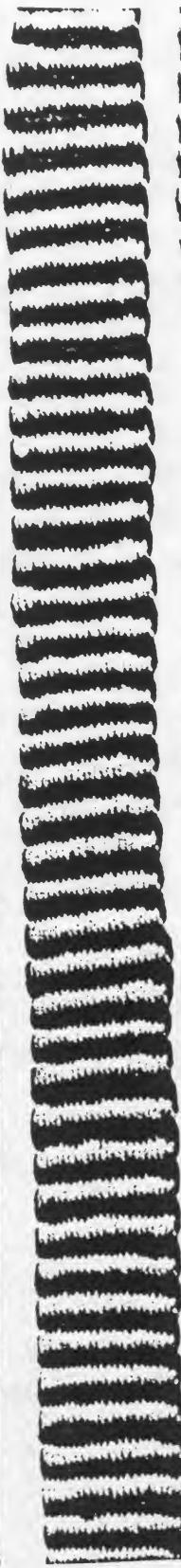
Let's assume you have decided to weave a black and white striped band and go through the steps you must take.



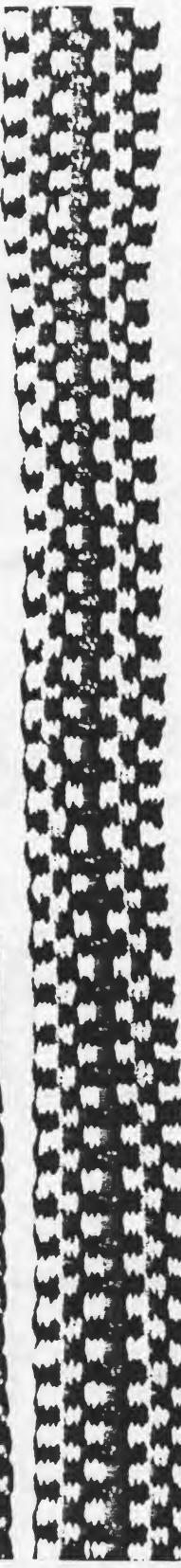
1. Looking at the heddle you will see that there are 24 holes and 23 slots between the holes. You will be threading your warp threads through both slots and holes so you won't be able to select more than 47 threads to weave. You can weave with many fewer than 47, but it is a good idea to use at least 40 so that your band will not be too narrow. This will also prevent the heddle from tipping from side to side as you weave.



STRIPES



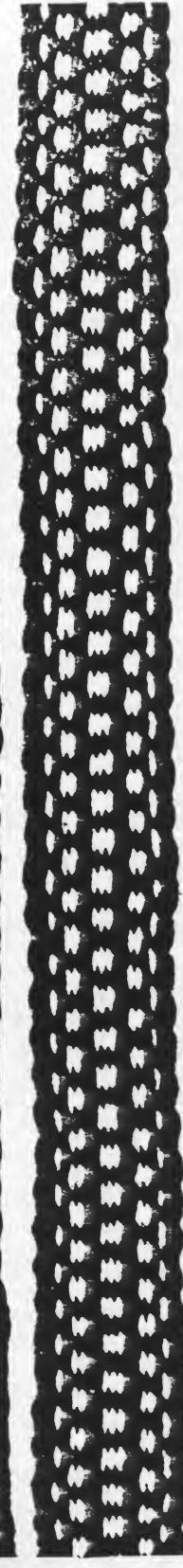
BARS



CHECKS



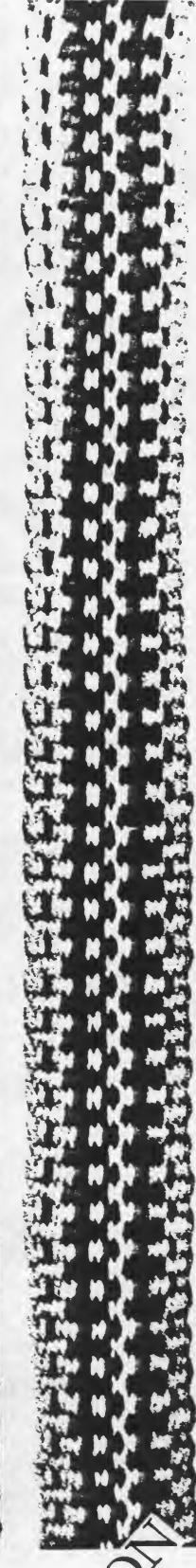
WAVY LINES



SPOTS



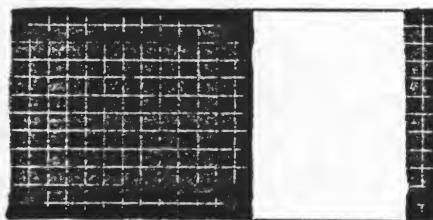
KEYS



COMBINATION

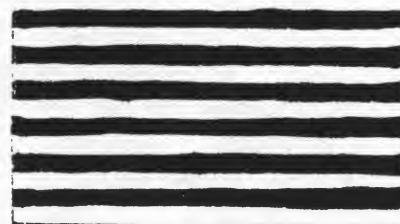
STRIPES

30 16



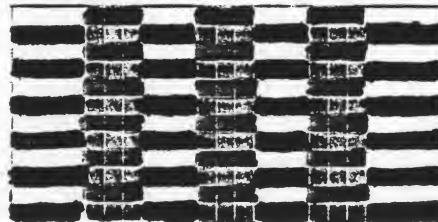
BARS

21 21



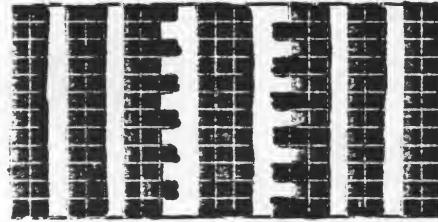
CHECKS

23 14 9



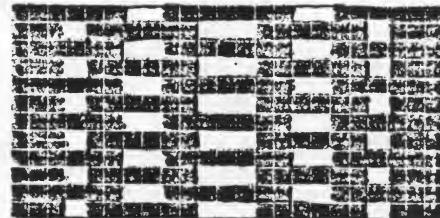
WAVY LINES

32 14



SPOTS

37 9



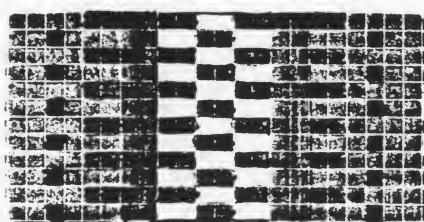
KEYS

28 18



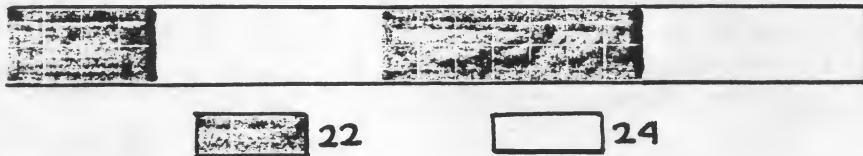
COMBINATION

18 20 6



2. Look at the diagram below and notice that there are 46 squares. The top row represents the threads that go through the slots, the bottom row threads that go through the holes. When you design your warp your diagram will tell you how many threads to use of each color and the order you will thread them through the heddle. If you use the computer you will be working with a similar diagram.

For your first sample you can combine different patterns, but your work will be much easier if you limit yourself to 2 colors.



3. The only thing left to do before beginning to make your warp is to decide how long to make the threads. For your sample project 50 to 60 inches will be a good length, but for your next band you may want to make it longer, depending on what you intend to use it for.

Let's suppose you have decided to make a belt for a friend. You will need to know his or her waist size and add about 12" for buckling or tying. If you want long fringed ends you must make it even longer.

Next you must add some more for what weavers call tie-up, the amount needed to tie the warp to a post plus the amount you will not be able to weave at the end of the band. Also add a few inches for mistakes at the beginning as you get started.

Usually 24" will be enough to add to the desired finished length of any project.

Length of finished belt: 40"
+24"
64" length of warp

DESIGNING WITH A COMPUTER

You can use your Atari and the weaving disk to experiment with design. Using the disk you can design both heddle and card weavings and save your weaving patterns for future use. You can also print out a threading diagram for weaving you decide to do.

The program allows you to:

1-design in 2,3 or 4 colors (the 4th being black)

2-erase and change your design

3-experiment with the 128 colors, hues and luminances that the Atari provides. This way you can look at each of your designs with many different color combinations before deciding to weave

4-save any pattern you wish on a disk

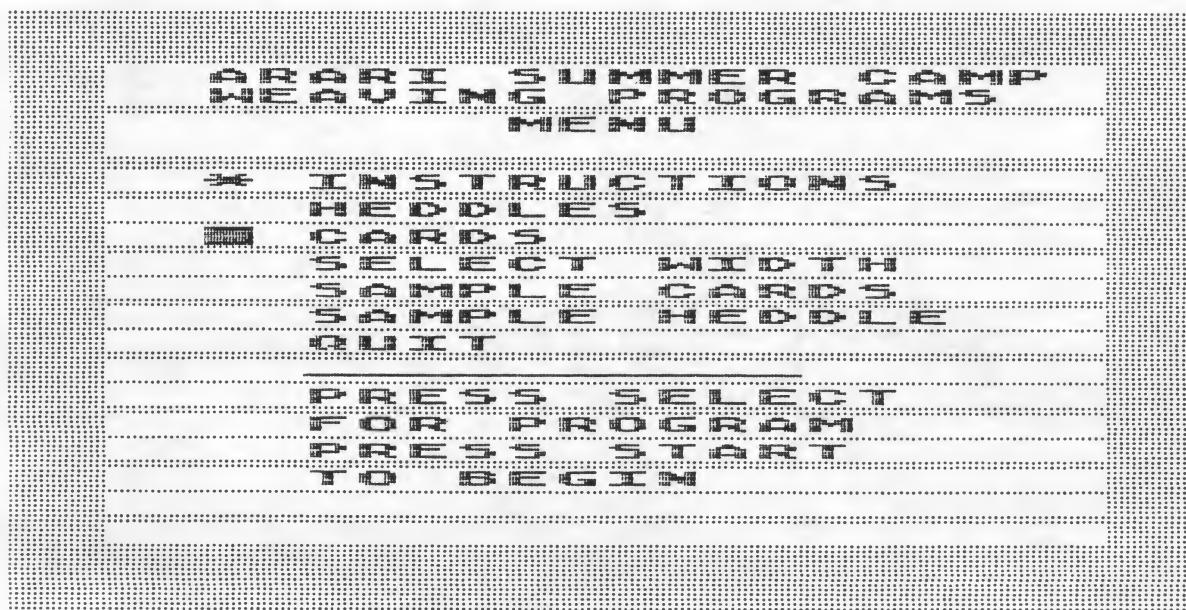
5-print out the threading pattern of any design

6-set the number of threads you intend to use. The range is from 2 threads to 23 threads per line, the range of your heddle and of beginning card weaving.

7-see sample card and heddle weaving patterns.

8-See your pattern changed through all the permutations and combinations of color available on your Atari. By pressing C first and then R the computer will automatically cycle your design. Be patient as the changes take place slowly. You can also save any color design you choose.

Here is the MENU of the weaving disk. It shows you the choices you have.



Now here is a copy of the INSTRUCTION page. You might want to keep it open as a reference until you get familiar with the program. You can also go to the instructions on the computer by pressing **m** to get to the menu and then going to INSTRUCTIONS. However this will erase your pattern and therefore it might be more convenient to look at the printed version of the page.

Notice that the instructions tell you how to:

- 1-do your original pattern
- 2-change colors
- 3-save, load or print a pattern
- 4-go back to the MENU and begin again.

A NOTE ON SAVING YOUR OWN PATTERNS:

When you want to save a pattern of your own you have to press **W** and then **D**. You will be asked to give your pattern a name. The name MUST BEGIN WITH A LETTER. Remember that name. Anytime you want to see your pattern again you must call it up by name.

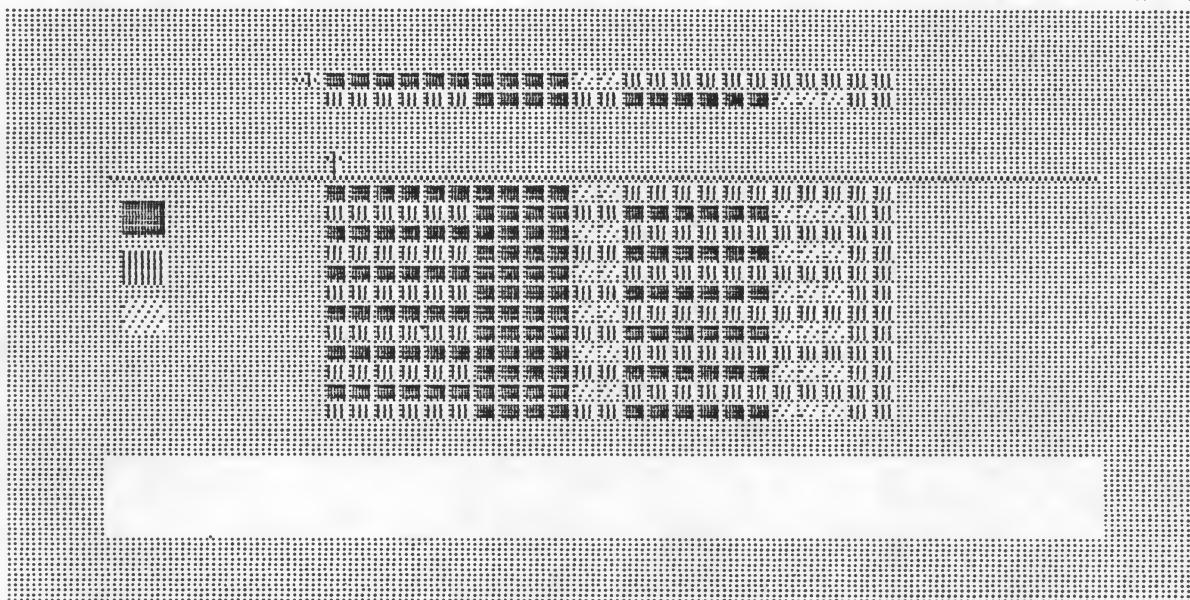
```
INSTRUCTIONS
KEYS TO PUSH WHILE WEAVING
1 - RED          2 - YELLOW
W - BLUE          4 - BLACK
< - MOVE BACK    > - MOVE FORWARD
U - MOVE HORIZONTAL ARROW DOWN
D - DISK STORAGE  I - REVERSE
DELETE - DELETE A COLOR
*****
C - COLOR CHANGE
KEYS TO PUSH WHILE CHANGING COLORS
-- - SUBTRACT COLOR
++ - ADD COLOR
F - NEXT COLOR    R - RANDOM COLOR
O - ORIGINAL COLOR
W - GO TO WEAVE BOARD
*****
TO RETURN TO MENU PRESS M
*****
FOR DISK STORAGE YOU MUST FIRST
PRESS W AND THEN PRESS D
H WILL ALWAYS GIVE A LIST OF COMMANDS
HIT ANY KEY TO GO BACK TO THE MENU
```

HERE IS AN EXAMPLE OF DESIGNING WITH A COMPUTER:

This is a heddle design using three colors. Under the design is a threading diagram. The design is called WILD. Designs that you would like to save on disk or weave need names so you can call them back whenever you would like to see them again.

The threading diagram is coded so that 1,2 and 3 correspond to the colors you decide on in your pattern. The top line on the diagram tells you which threads to put in the slots and the bottom tells you which one to put in the holes.

Under the threading diagram is a list of your warp specifications. It tells you how many lengths of each color you will need for your weaving.



THREADING DIAGRAM WILD

1 1 1 1 1 1 1 1 1 1 3 3 2 2 2 2 2 2 2 2 2 2

2 2 2 2 2 2 1 1 1 1 2 2 1 1 1 1 1 1 3 3 3 2 2

0 BLACK 20 RED 21 YELLOW 5 BLUE

In order to get this you have to press W and then press D. This illustration shows what will come up on the bottom of the screen. P is the print option that will give you the threading diagram and the warp specifications.

S will allow you to save your pattern on disk, L will allow you to load an old pattern (which is why patterns need to be named).

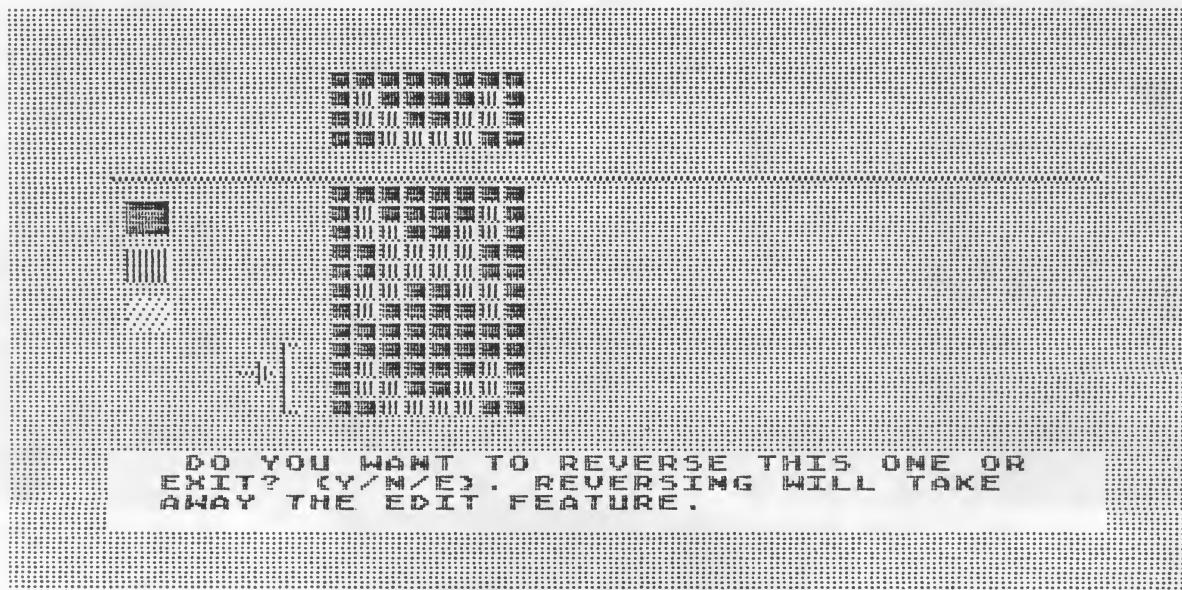
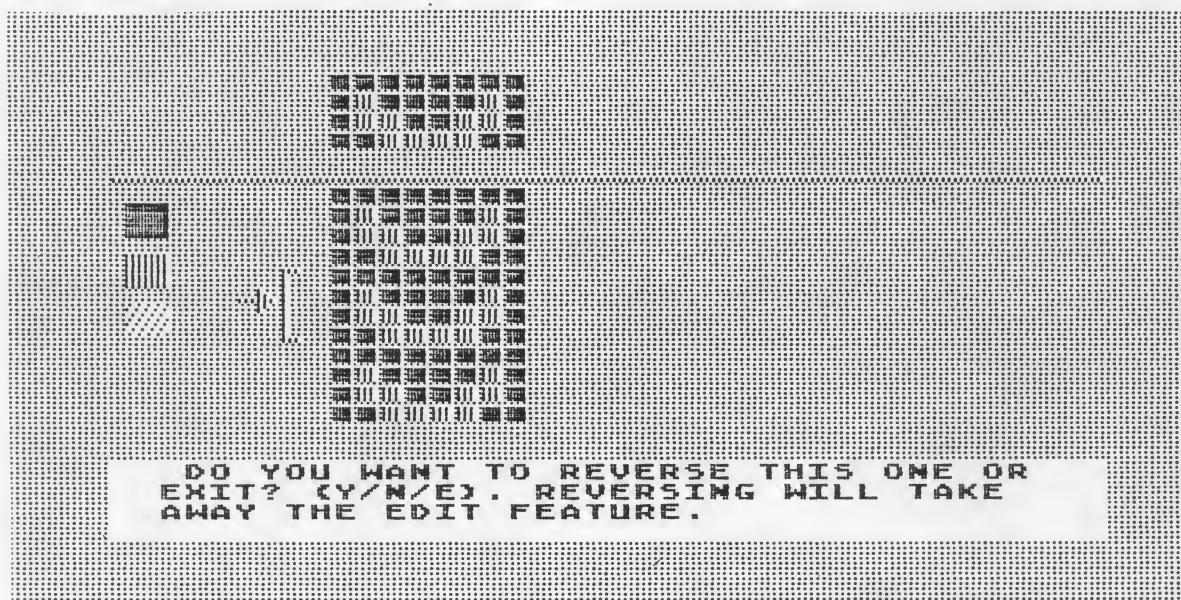
DISK STORAGE
SAVE, LOAD, PRINT OR EXIT? (S/L/P/E)

HERE IS A SAMPLE OF CARD WEAVING. This sample was done with 8 cards (the number of squares in each line). The card weaving program has an option that the heddle program doesn't. If you press "I" you can invert your 4 line card design. This corresponds to turning the cards in the opposite direction than you began with (for specifics see the section on card weaving).

When you press "I" you will see a bracket and arrow on the screen in front of the first 4 line repeat of your design. You will also be asked whether you want to invert this 4 line segment or not. If you do lines 1,2,3 and 4 will become 4,3,2 and 1.

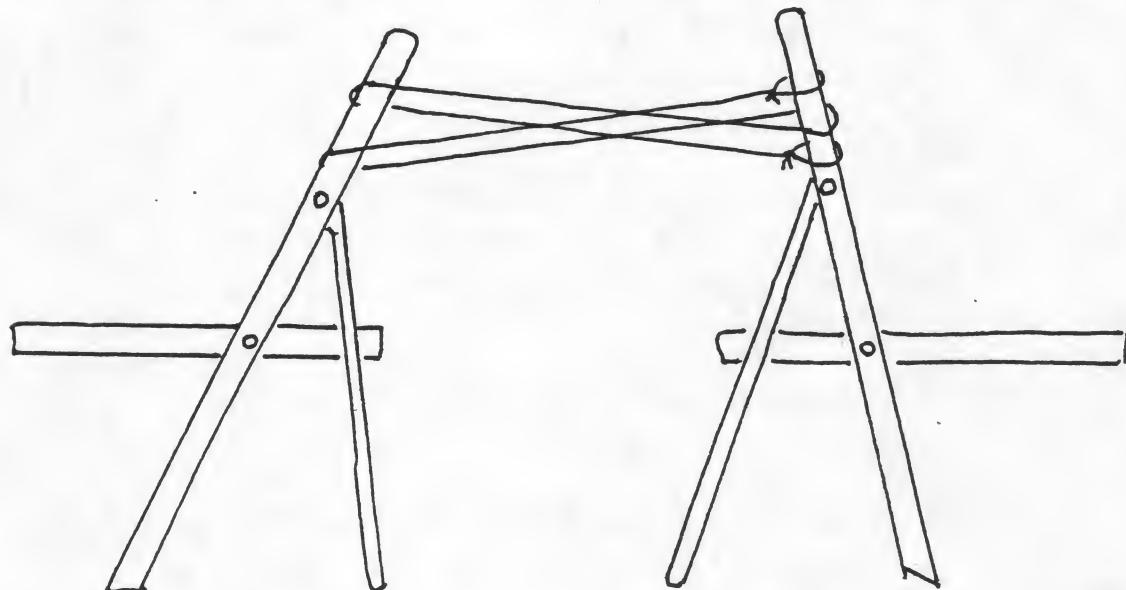
To see the design possibilities that this inversion creates refer once more to the section on card weaving.

You will be able to use the original pattern and the inversion of that pattern in any combination of the three four line repeats that are on the screen.



WINDING A WARP

The easiest way to measure out warp threads is to wind them around two fixed points. You can use the legs of an upside-down table, the backs of 2 chairs, C-clamps fastened to a table top, nails pounded into a wall or onto blocks of wood that are then clamped to a table, shelves or a counter.

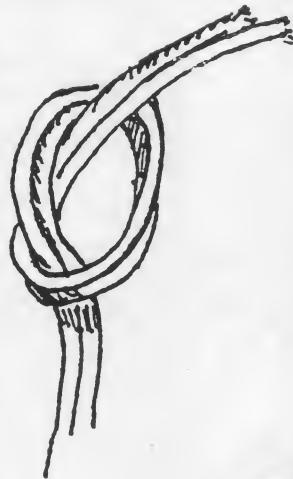


For the first sample you will want to have your warp about 50" long so place your warping posts 50" apart.

1. Loosely tie the end of the first color onto the first warping post.
2. Pass the yarn around the end post and return to the first one. You have now wound 2 threads, or in weaving terminology, 2 ends.
3. Continue winding the yarn around the posts until you have the number of threads of color 1 that you need for

your design. Set the ball of yarn down, but don't cut it off yet.

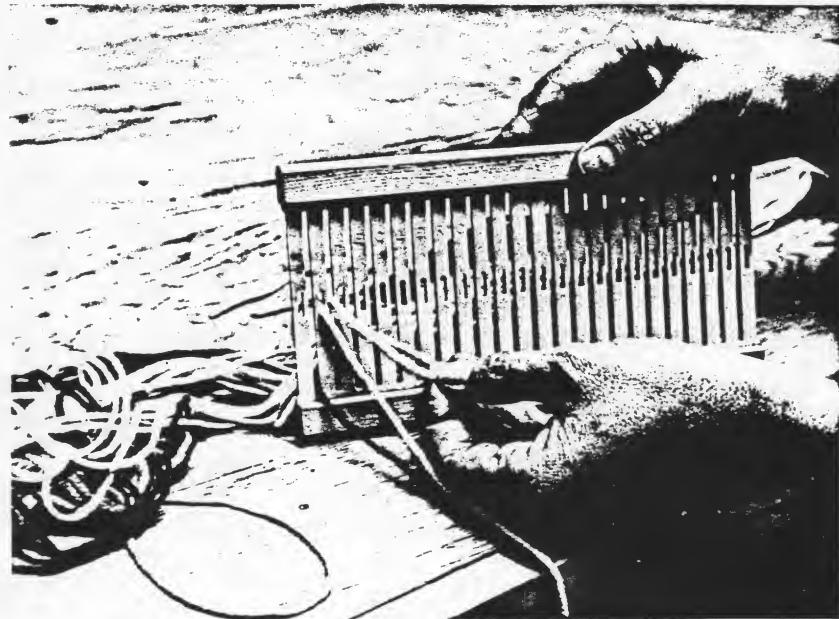
4. As tightly as you can, tie a short length of string or yarn around all the warp threads about 18" from the first post.
5. Now you can cut off the ball of yarn leaving an end about 3" longer than the other threads. Take color 2 and tie it to color 1 in an overhand knot.
6. Wind the required number of ends of color 2. Be sure to tie a tight string around all of these ends 18" from the first post, just as you did for color 1.
7. Repeat the above for each color in your design.
8. Now tie tight cords around your entire warp in several places along the length of the warp. This will keep your warp from tangling while you thread your heddle.



TAKING THE WARP OFF THE WARPING POSTS

1. Grasp all the warp ends in one hand near the end post (the one farthest from where your colors are separately tied together). Cut through all the loops at the point where they go around the post. If you're using C-clamps you will have to loosen the clamp a bit and slide it forward. Tie all the cut ends together in a loose overhand knot so that all the ends are secure. You will be untying this knot soon, so be sure not to pull it too tightly.

2. Remove the opposite end of your warp from its warping post and cut the looped ends. Do not tie these ends in a knot.



THREADING THE RIGID HEDDLE

1. Place your warp on a table with the unknotted ends in front of you.
2. Leaving the tight strings on the warps, separate the different colors from each other.

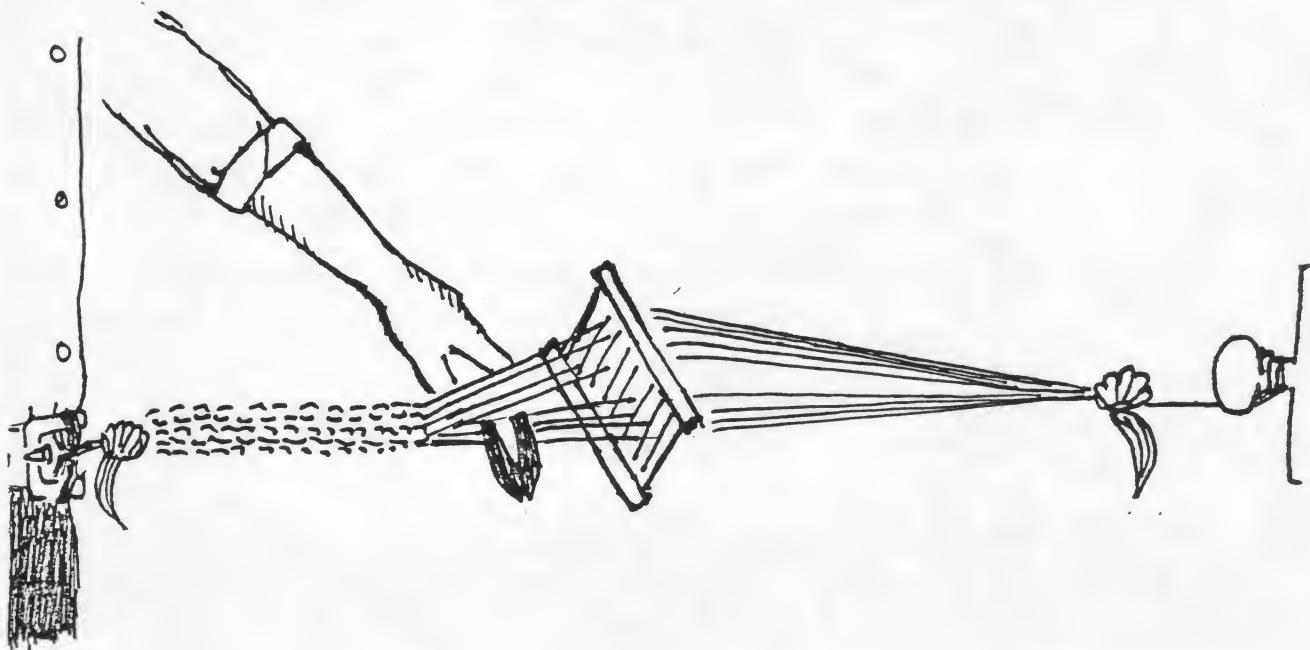
3. Get your design with the threading diagram and a rigid heddle.
4. You want your warp to be centered in the heddle, so if you have fewer than 46 threads you must figure out how many slots or holes to leave empty at each end.
5. Read your diagram and thread your heddle from the left hand side.
6. Beginning with the first slot work across the heddle from slot to hole threading the warp yarns through just as you diagrammed them. This means that you will read from top to bottom, then over to the next top thread, then a bottom one, etc., until all the threads are threaded through the heddle. If you start getting lost try marking off the squares on your diagram as you thread.

THREADING IS EASIER IF YOU FOLD THE END OF THE YARN OVER AND PUSH THE LOOP THROUGH.

7. Check to make sure you haven't missed any slots or holes, or threaded more than 1 thread through each opening. If you have made a mistake in the number of threads you wound:
TOO MANY? Just leave them until step no. 4 below.
NOT ENOUGH? Wind however many more you need, carefully thread them through the heddle and go on to the next step.
8. Gather all the ends together making sure they are fairly even with each other. Tie them in a nice tight overhand knot. Double check to make sure all the ends are caught in the knot.

TYING UP THE WARP

1. Find a strong unmovable object that you can tie your warp to. It should be at least as high as your waist will be when you are weaving.
2. Tie a strong (very strong) piece of string around the knot at the heddle end of your warp. Make this cord long enough to tie around whatever tie-up place you have found and tie your warp to it with a bow that can be untied easily. We'll call this the anchor knot.



3. Carefully untie or cut all the tight cords you tied around your warp.
4. If you have any extra warp threads pull them out and cut them off near the anchor end of the warp. If you added warps tie them into the anchor knot.
5. Untie the loose knot you made at the non-anchor knot end of your warp.
6. You are now going to slide the heddle down to the opposite end of the warp. You will no doubt find some tangles, but when you're done with this step you'll have a nice tangle-free warp. Grasp the warp in one hand, stand back from the anchor knot so the warp is stretched out. Holding the ends firmly give the whole warp a few sharp tugs as you pull the heddle toward you with your other hand. You can also comb the tangles out with your fingers or pull badly crossed threads free one by one.

PATIENCE AND CALM HELP HERE.

Should you BREAK A THREAD measure a new one, tie it into your anchor knot and thread it through the heddle. Cut off the old broken thread near the anchor knot.

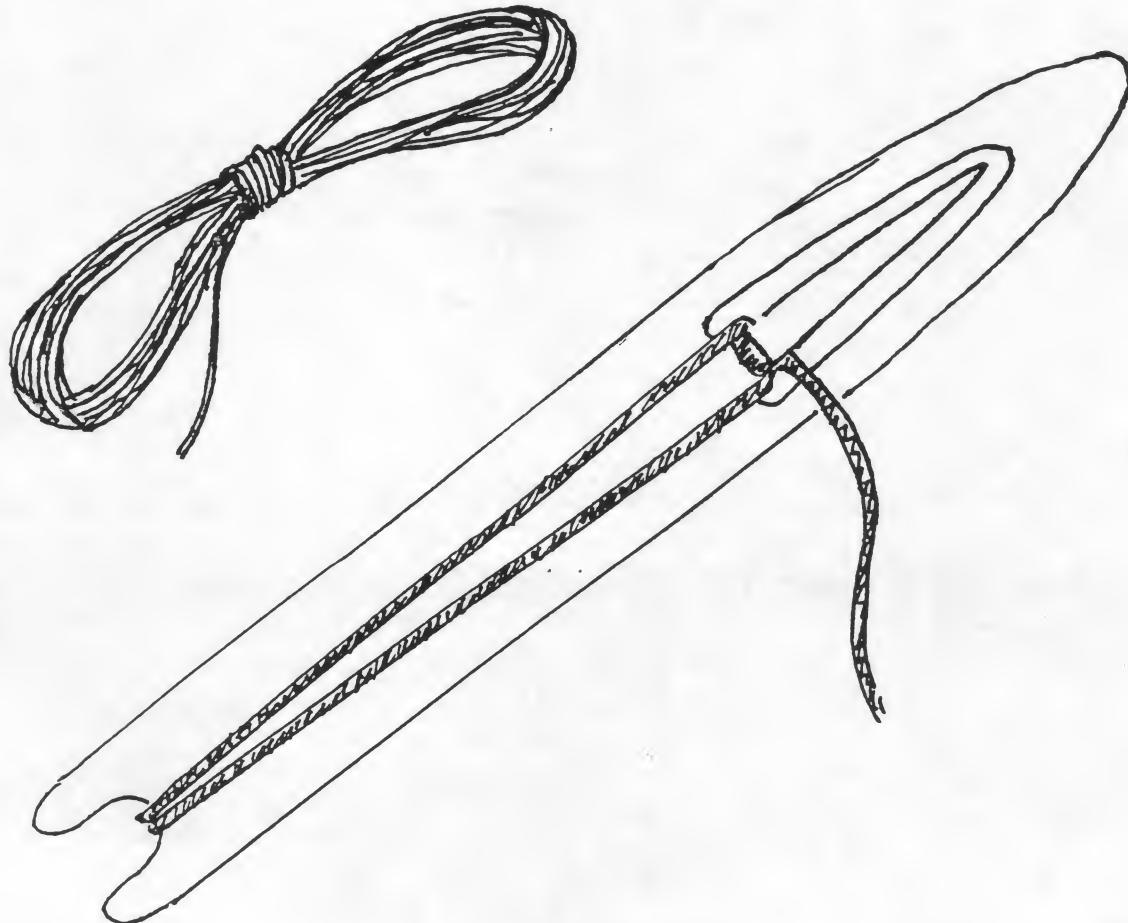
7. As you get the heddle a foot or so from the end of the warp carefully let go of it and do a final combing as you pull the warp ends together and try to get the tension on the ends even. When you can't see any ends sagging between the heddle and the anchor knot tie all the loose ends into an overhand knot. If you miss some threads untie the knot and try again.

THE WEFT

The weft thread is the thread that you will weave into your warp. In warp-faced weaving the weft shows on the edges, so you will want to choose a color that goes well with your warp. To begin choose a weft of about the same thickness as your warp threads. Later you may want to experiment with different thicknesses.

Once you have selected a weft take a netting needle (which we will call a shuttle) and wind yarn around it as in the drawing below. You turn it over each time you loop the yarn over the loose prong.

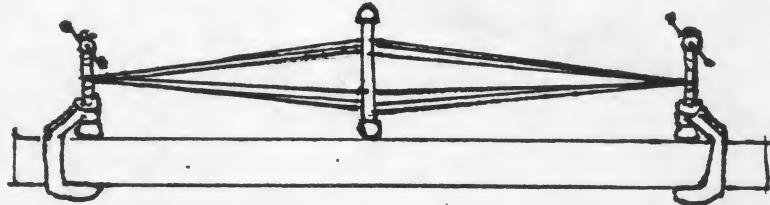
If you don't have a netting needle you can wind your yarn into what is called a butterfly.



TYING UP THE WEAVER

Now that you have knotted both ends of your warp and prepared your weft you are almost ready to weave. The last step is to tie the heddle end of the warp to yourself or to something else. There are several ways to do this. You can:

1. Tie a cord around your belt loops and tie this cord around the warp knot in a bow, as close to your body as possible.
2. Tie a cord or strip of cloth around your waist and tie this to the warp knot, again using a bow.
3. Tie a cord around the knot and tie this to a chair back or arm
4. Tie both end knots to C-clamps which are fastened to a flat surface.



Unless you have a bad back the first and second methods are usually easiest and most portable. You also will find it easier to control the tension of the band while you weave.

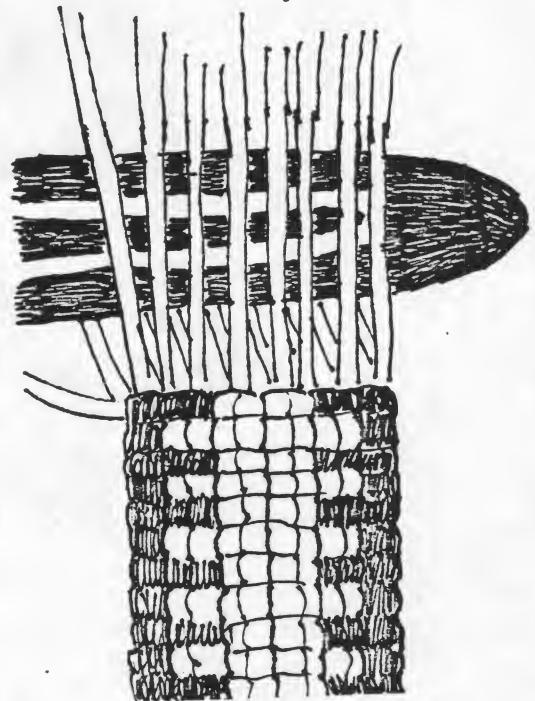
Whichever method you choose make sure that the knot or tight bow you tie around the warp can be unfastened easily.

WEAVING THE BAND

Now that you've threaded your heddle and secured both ends of your warp you are finally ready to weave.

Push the heddle away from you so that it is about 18" from the knot at your waist. When you move the heddle up and down you will notice that there is a space between the threads. This is the space you will weave your weft through, and it is called a shed. When you lift the heddle up the threads you threaded through the holes are raised. When you push the heddle down the slot threads are the upper threads. You are going to weave your weft through the first shed, then the second, then the first again and so on until you have woven in and out of most of the warp, and here is how you will do it.

1. With the heddle lowered push the shuttle through the shed as close to the waist knot as possible leaving several inches of tail hanging out. Ignore this tail for now.
2. Raise the heddle and put the side of the shuttle or your hand in the shed and pull it toward you. This is called beating. Check to see that no threads are caught, sagging or twisted.
3. Push the shuttle back through this second shed starting from the side it exited on the first shot. A shot is one passage of a weft across a warp. Gently

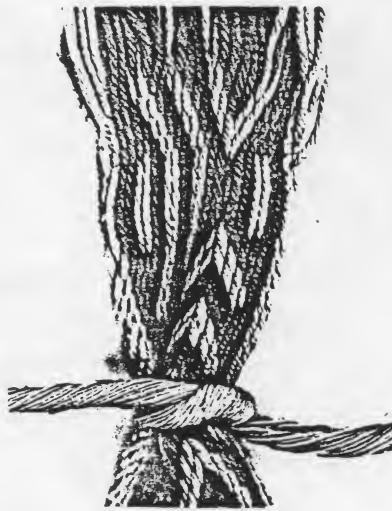
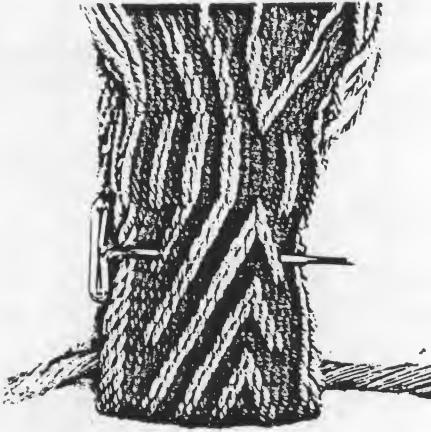


adjust the weft thread so that there are no loops at the edge or between the warp threads.

4. Lower the heddle, beat the weft thread down toward you, adjust the weft if necessary and weave the weft. Repeat these steps to the end of the warp:

CHANGE SHED
BEAT
ADJUST WEFT
WEAVE

5. Soon your heddle is going to get too close to the weaving and too far away from you. You must now untie the warp from your waist and refasten it around the part of the band that is already woven.



Pin band over waist cord or Tie waist cord around woven section

If you have tied the end to a C-clamp you will not have to do this, although you may have to loosen the tension every once in a while because the warp will get tighter as you weave.

THE FIRST FEW WEFT SHOTS WILL LOOK SLOPPY AND DISAPPOINTING. In fact, your entire first band will probably not look the way you imagined when you planned and warped it. The weaving may be uneven, you may have missed some threads here and there, the strip gets too narrow or too wide. THINK OF THIS FIRST TRY AS AN EXPERIMENT which will give you ideas and practice in weaving. YOUR SECOND ONE IS GUARANTEED TO BE AN ENORMOUS IMPROVEMENT!

Here are some PROBLEMS you may have and SOLUTIONS:

1. Weaving spreading out so that weft shows.

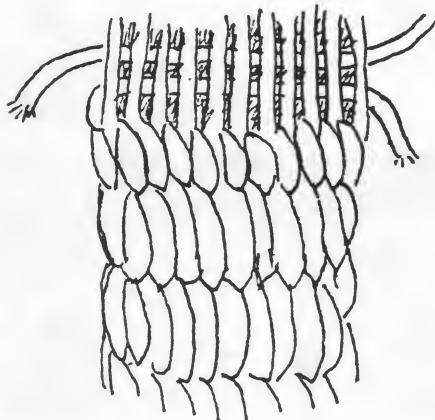
- Pull your weft thread in gently but firmly after each beat.
- Don't let the heddle get too close to the weaving. Because it is wider than your band it tends to force the warp out if it is too close.
- You may be beating too hard - relax.

2. Band is getting too narrow.

- Don't pull the weft so tightly.

3. You are discovering loops of weft on the underside.

- You have entered the weft from the wrong side. Make sure you enter it from the side you just exited.
- Your shed may not be clear because some threads are sticking. Be careful when you beat:



4. You run out of weft.

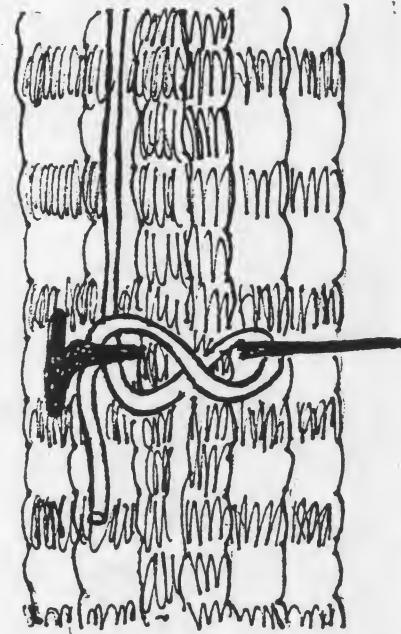
- Wind a new weft on your shuttle. Leave the old weft dangling out the edge. Weave the new weft in the same shed as the old one, leaving the end dangling out the opposite side. Continue weaving with the new weft. (You'll fix the hanging ends later.)

5. Warp threads are sticking together giving a bad uneven shed.

Try increasing the tension on the warp by pulling back harder or moving your chair back an inch or two.

6. A warp thread breaks!

Measure out a new thread, tie it to the anchor knot, thread it through the heddle where the broken thread was threaded, pin it to the woven band. Pull out the old thread and cut it off near the anchor knot. The broken end in the weaving will be fixed when you finish the entire band.

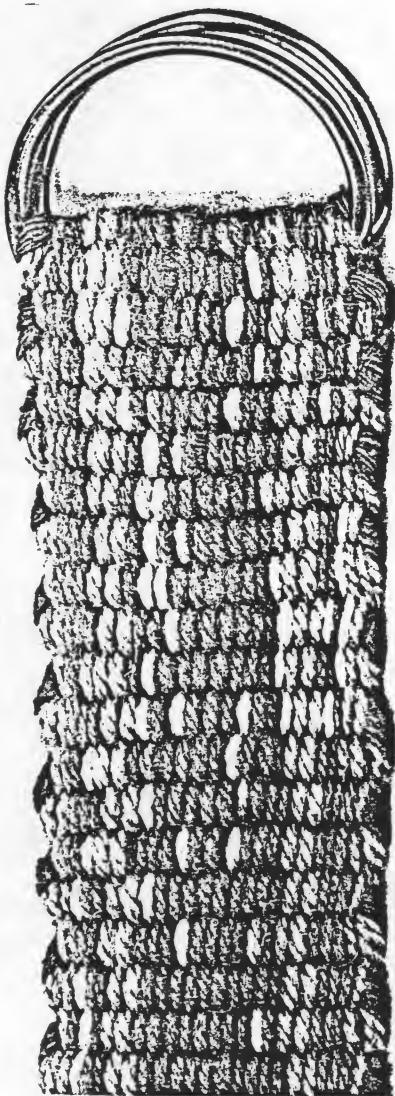


Before you get to the end of your warp you may want to experiment with different weft threads. See what happens when you weave with very thin wefts and extremely thick ones. What happens to your design when you alternate one thick and one thin weft?

When you near the end of your warp you will find it increasingly hard to weave. The heddle doesn't lift the threads high enough to get a good shed, and your band is spreading out too far. It's time to put down your weaving, cut or untie the warp - and begin again!

FINISHING

Even the most ordinary looking weaving is improved by finishing. Cut any overlapped threads sticking out from the sides of the band. If you had any broken threads thread a tapestry needle with the loose end and weave it into the band for about 1½ inches. Cut off the ends so they don't show.



There are several simple ways to finish the fringe ends of your band. You can cut the unwoven threads off where the weaving ends, turn the ends under and hem them. If you decide you want fringed ends to prevent the weft from unravelling you can knot the ends using overhand knots that you push up against the last row of weaving. Braided ends are another possibility. Most weaving books have a chapter on finishing techniques.

If you intend to use one of your bands as a belt you can purchase a buckle and sew it onto one end. When you make your warp you can even loop the middle of the warp over the buckle and tie the buckle end to your waist when you begin your weaving. If you decide to do this remember that you must not cut the loops at the buckle end of the warp.

Another last finishing touch is to wash your band in lukewarm water and let it dry on a flat surface. Or you can press it with a steam iron. Washing and pressing tend to eliminate a lot of unevenness in the weaving.

MORE BAND WEAVING

There's no reason to restrict yourself to weaving belts. If you think about sewing several strips together you can make pillows, bags, baskets, wall hangings, vests, mats and even small rugs.

If you want to weave on your own you will probably want to try different kinds of yarn, string or even light-weight rope. The only requirements for material are that it be strong--if it survives a quick yank when snapped between your hands it should work--and that it be fairly smooth rather than fuzzy. Wool, camel hair, cotton, silk and linen plied yarns make beautiful bands.

The back page of this booklet has a list of a few of the yarn and weaving supply shops that have mail order departments and stores that supply rigid heddles and cards for card weaving.

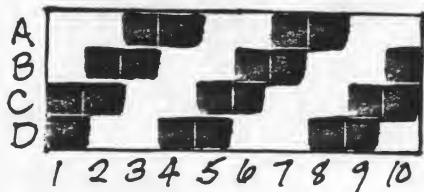
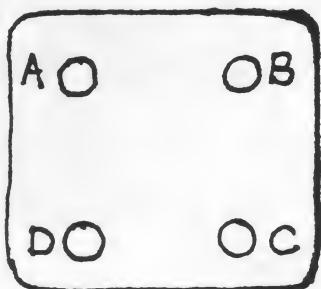


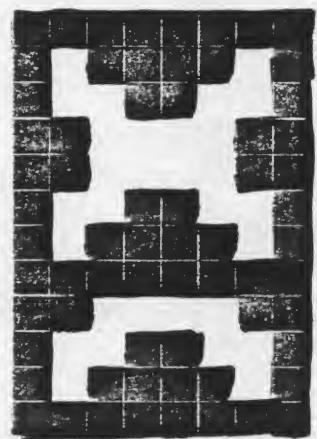
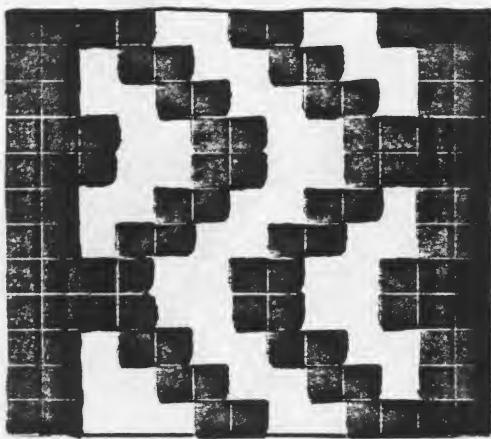
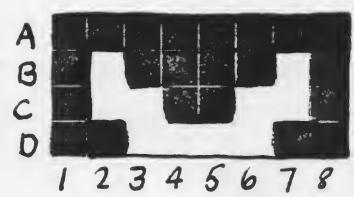
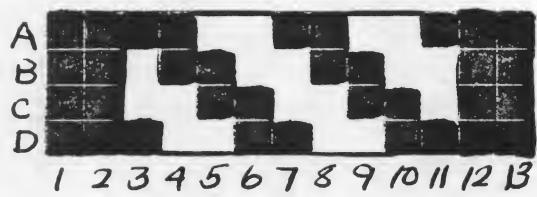
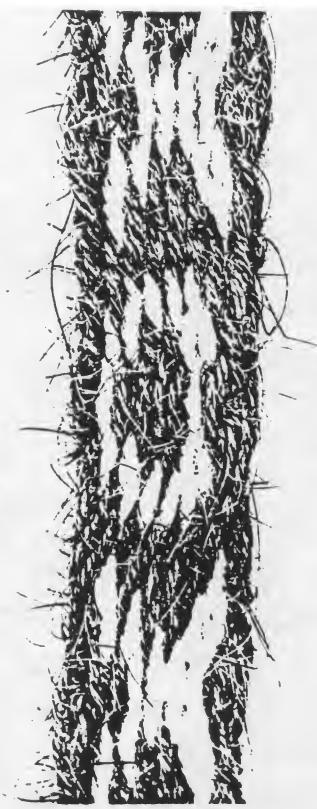
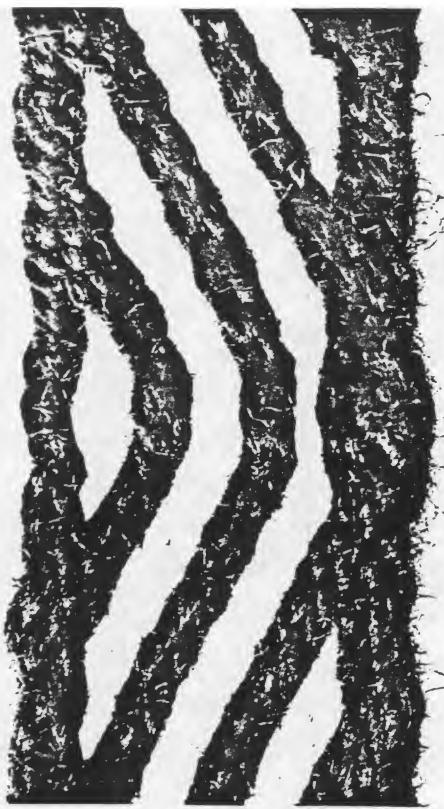
CARD WEAVING

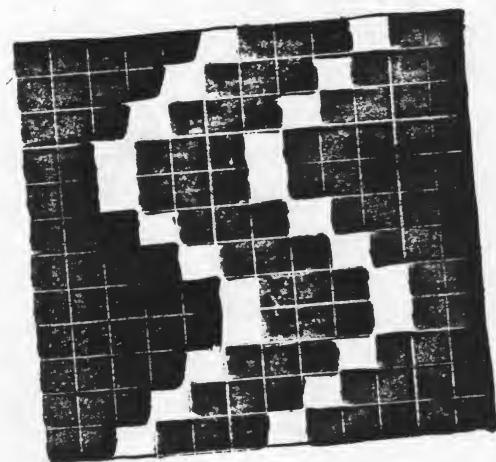
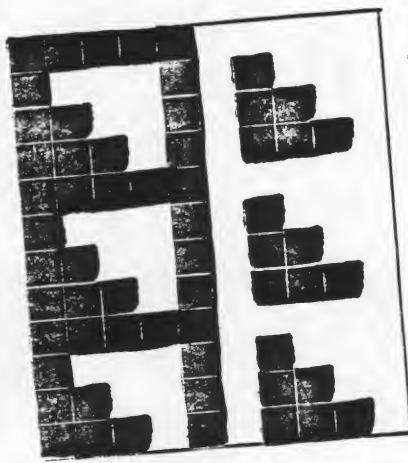
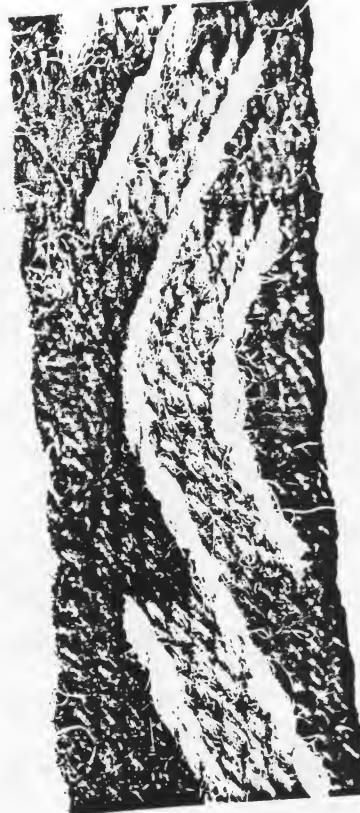
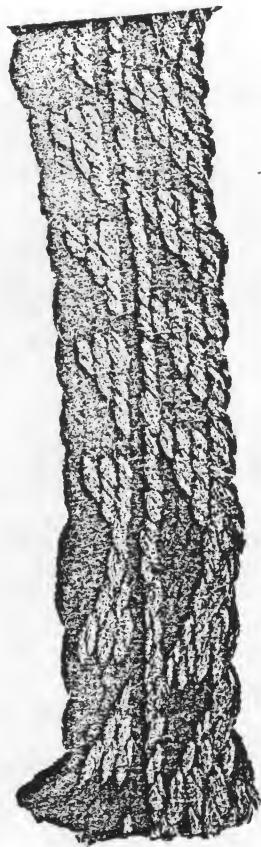
Card weaving has been around for at least 2,000 years. It has usually been used to make decorative bands, belts and trimming and more recently wall hangings. It is a complex type of weave, but it is not a difficult one to weave and requires nothing but small cardboard cards and yarn. The patterns that can be woven are almost endless. It is also an extremely strong weave, making it ideal for belts, ties, saddle girths, even shoelaces. As with the weaving you did with a rigid heddle strips may also be sewn together to make wider pieces.

Look at the illustration below where you will find a graphed pattern design and a card. The card has 4 holes lettered A B C and D. The yarn ends are threaded through these holes according to the graphed pattern. On the graph the letters stand for the holes in each card. The numbers refer to each of the cards. This particular design is for 10 cards. The first 4 vertical squares on the graph refer to holes A B C and D on card 1, the 4 squares above 2 tell you which colors to thread through the 4 holes on your second card. Card 1 will have light threads in holes A and B and dark threads through C and D. Card 2 will have light colors in A and D, dark in B and C.

To get a shed with a rigid heddle you lifted the heddle up and pushed it down for a second shed. With cards you will have 4 sheds that you get by turning the cards in different directions.



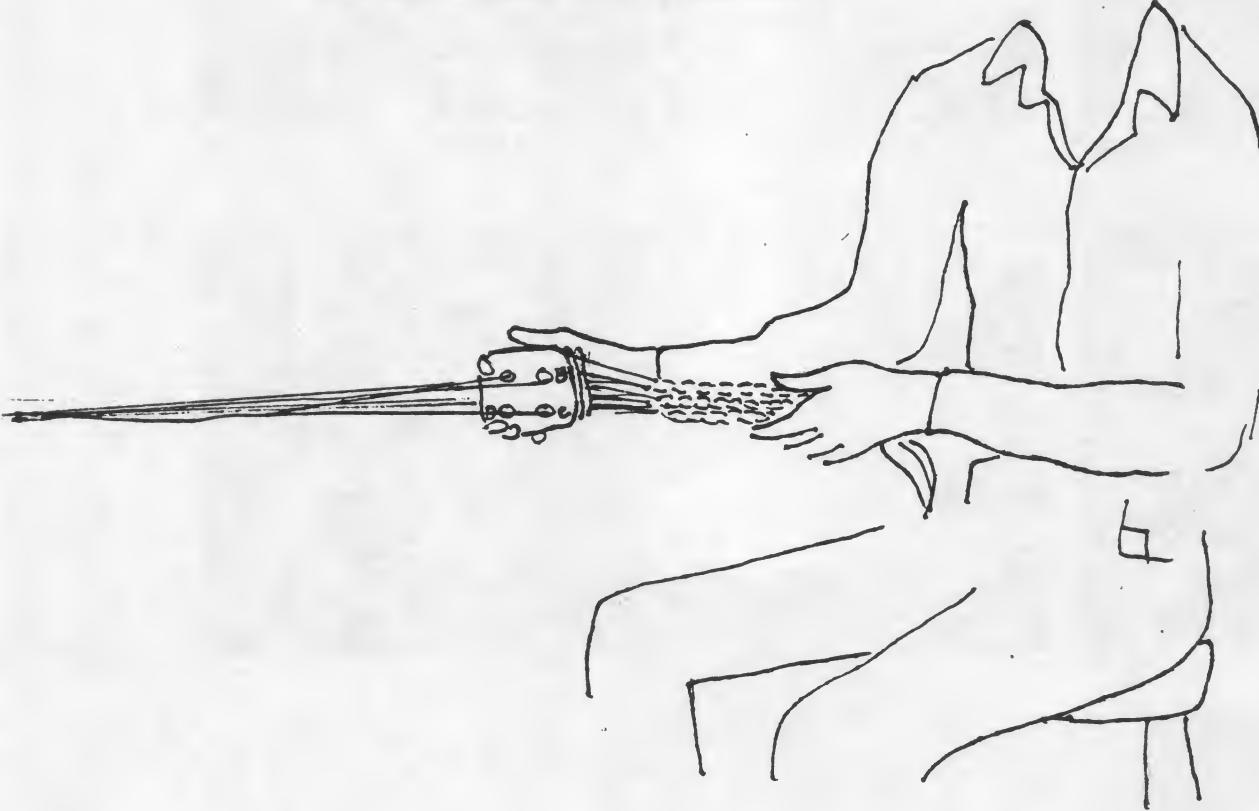




To begin your card weaving pick a design from the preceding pages (or if you're feeling very confident design your own). Count the number of each color in the diagram. You then wind your warp exactly as you did for rigid heddle weaving.

Next you will get the number of cards needed for the design you have selected and thread them as follows:

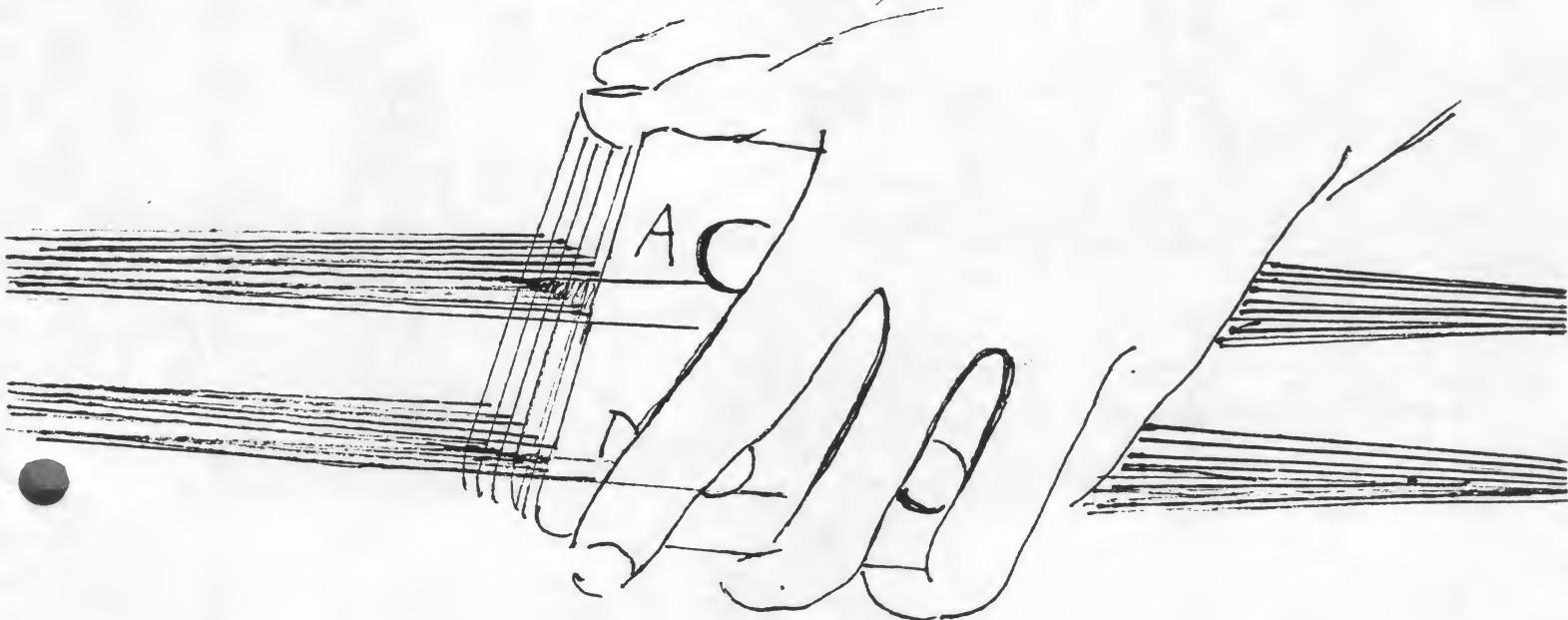
1. Number each card in pencil in the upper right corner, 1 through the last one.
2. Pick up card 1 and, looking at your diagram, select the proper color for card 1, hole A. Thread this thread through from the front side to the back and leave about 1 foot sticking out the back.
3. Do the same for holes B C and D on card 1. Then place the card down carefully, letter side down. Try to keep the ends even and together.



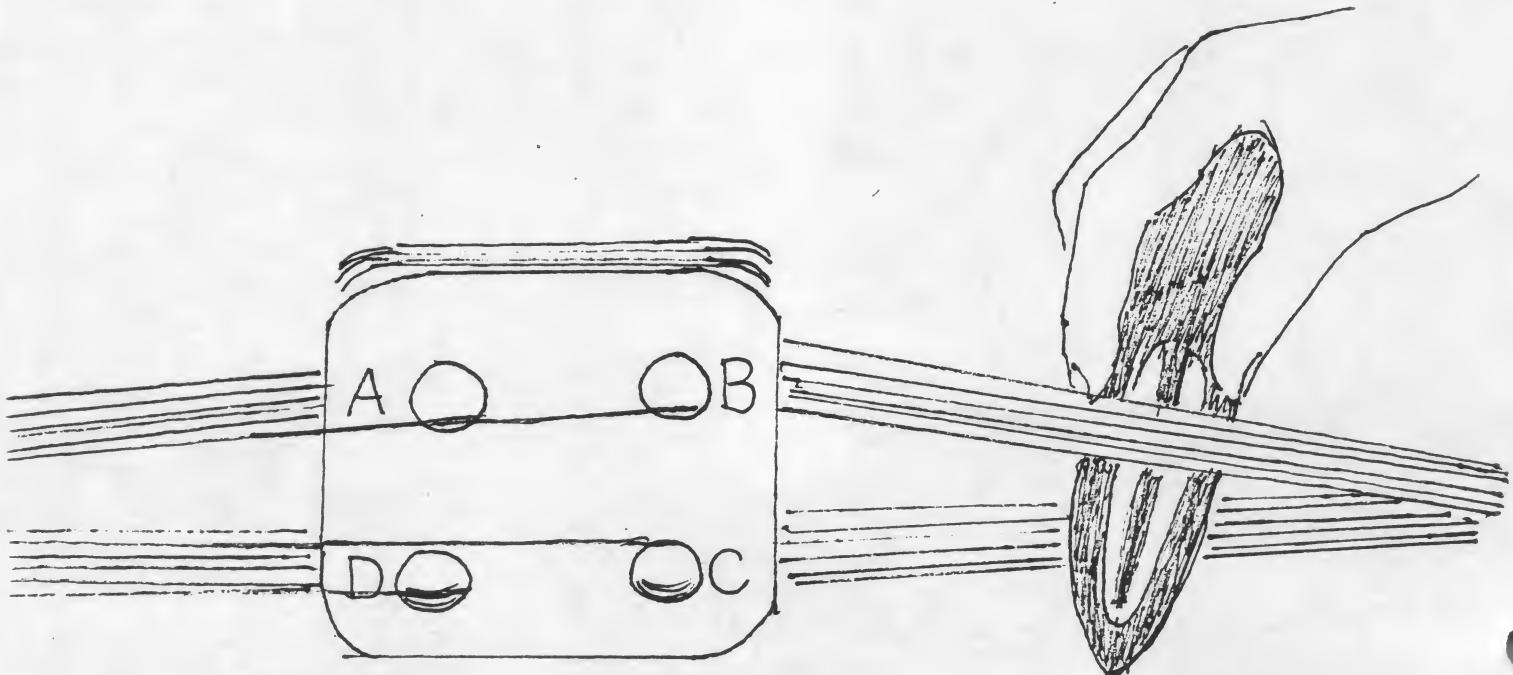
4. Pick up card 2 and thread it as indicated in the diagram. Place this card face down on top of card 1. Be sure the yarn goes through the holes from front to back.
5. Continue until all the cards are threaded. Keep them stacked neatly with the A holes on top of each other, the yarn ends coming out side AD.

TYING UP

1. Carefully make sure your cards are all facing the same way. The AB edge should be on top and the loose ends coming out side AD. Place a rubber band around the bunch of cards.
2. Untie or cut the cords that separate the colors of your warp.
3. Pull the yarn ends together as evenly as possible. Tie them together in an overhand knot. This will be your anchor knot. Tie a cord around the knot and tie it to a sturdy place.
4. BE CAREFUL! (This might be a good time to look at the video again.) Untie the knot at the other end of the warp. Hold your cards like this:



4. Remove the rubber band.
5. Begin to slide the cards toward you until they near the untied end of the warp. Untangle crossed threads when necessary.
6. If you have to stop for any reason put the rubber band back around the cards before you put them down.
7. When finally your cards get within 1 foot of the end pull all the ends together as evenly as possible, with no sagging threads between this end and the anchor knot. The lettered side of the cards should be facing your left hand. Tie the ends together in an overhand knot.
8. Carefully set down your cards. (Don't forget the rubber band!)
9. Choose a weft thread and wind it on a netting needle. The weft will only show at the edges.
10. Tie the warp to your waist in your favorite way or fasten it with C-clamps.



WEAVING

1. Once your warp is tied up and under tension you will be able to see a shed between the top set of threads and the bottom set. Weave your weft through this opening just as you began your rigid heddle weaving. Make sure:
 - the cards are all together and in the right order. If you can't get them to stack neatly it might be because some of the threads are crossed. Check the corners of unruly cards. Remember that the tighter and more uniform you can keep your tension the less chance there is for threads to get out of place.
 - You may have to slide your card bundle forward and back a bit to get a good shed. As with any weaving the first few shots are the stickiest and most difficult. Be patient and relax. It will get easier!
2. Holding your cards together push them forward with your thumbs until the top side moves $\frac{1}{4}$ turn and the BC side is on top. Slide your cards forward and back to clear the shed, beat the first weft down toward the waist knot and weave your second weft shot.
3. Turn the cards forward another $\frac{1}{4}$ turn, beat, weave. Repeat once more for a total of 4 weft shots.

A BASIC PRINCIPLE EMERGES

You will see that the warp threads between the cards and the anchor knot are beginning to get twisted. If you continue to turn the cards in a forward direction only the twisting will eventually make weaving impossible. If you want to continue the design you get from turning in this direction the only solution is to untie the anchor knot, untangle the

twisted threads and retie the anchor knot.

The majority of card woven designs depend on a combination of forward and backward turns, which untwists the twists automatically. A common repeat is 4 turns forward and 4 back. Since you have a 4 line weaving design--the ABCD lines corresponding to the ABCD holes in the cards--this gives you a full pattern--4 forward--and its mirror image--4 back.

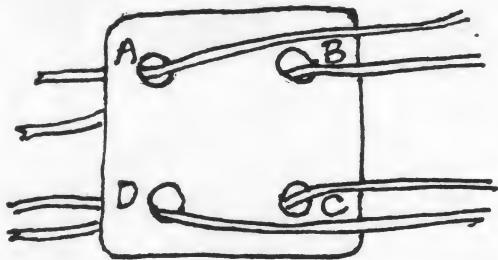
The order and number of turns is completely up to you which is one part of card weaving that makes it so much fun. Try turning the cards forward 8 turns, back 4. Try ANY combination of turns and see what comes up.

At least on your first attempt at card weaving it is best to ignore weaving mistakes. Don't try to undo your wefts because you stand an excellent chance of getting entangled and confused. Just keep right on playing around. Do be sure to check your cards once in a while to make sure they are all in the right order and all the holes are lined up correctly.

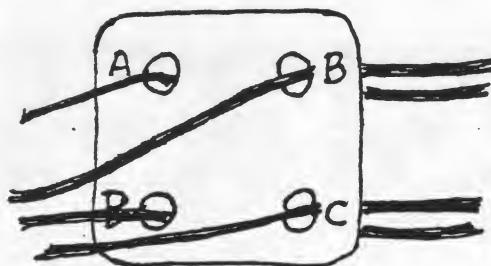
New wefts and broken threads are treated exactly as they are with rigid heddle weaving.

Once you have woven a strip or two the design principles will become clearer to you, and you will probably enjoy playing around with possibilities on the computer. It is a wonderfully fast way to see the different ways a 4 line draft will weave. When you feel confident about increasing the number of cards beyond what the computer screen will allow you can always sketch out a rough draft on paper, put it on the computer in sections and join the print-outs together when you've finished.

A CLEANER DESIGN



FRONT TO BACK

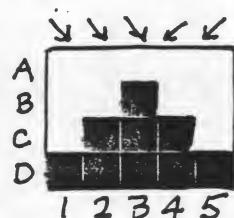


BACK TO FRONT

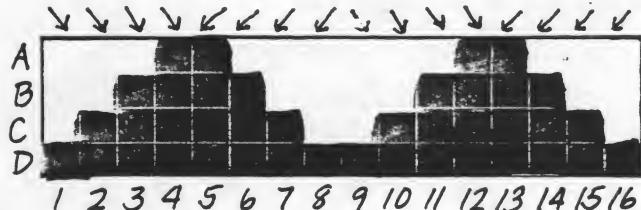
If you look closely at the grey card-woven band on the display board you will notice that one half of the X or O is "fuzzy" compared to the opposite side. Whenever you have a design that contains a reversal or a mirror image--diamonds, circles, chevrons etc.--you can get a clearer more symmetric pattern by changing the way you thread your cards.

So far you have been threading your cards from the front, or printed side to the back. \searrow is the symbol used to indicate this direction. Thread the first half of the pattern below in the usual front to back way. Then thread the other side of the pattern with the threads entering from the back and coming out the front. \swarrow indicates that the card below the arrow is to be threaded from back to front.

All 4 holes in each card must be threaded either all front to back or all back to front or the card will not turn.



Here's another one:



FLIP FLOP

The underside of a card-woven band is not the same as the top. If you decide you like the bottom better and want to weave it bottom side up simply turn the cards and band upside down so that the fronts of the cards face your right hand.

HERE'S A TOUGH ONE

You might have fun designing an alphabet. Remember you have only 4 lines to work with, and you will have to consider what happens when letters run into each other as you turn the cards. Here's one way to begin:



SUPPLIES

The following stores are two of many that sell yarns and weaving equipment by mail.

The Handweaver
1643 San Pablo Avenue
Berkeley, California 94702

Yarns and rigid heddles

Straw Into Gold
3006 San Pablo Avenue
Berkeley, California 94702

Yarns, rigid heddles, cards

BOOKS

Here are several books that you may find interesting:

Phyllis Morrison, Spiders' Games: A Book for Beginning Weavers, U. of Washington Press 1979.

Else Regensteiner, The Art of Weaving, Van Nostrand Reinhold, New York 1974.

Harold and Sylvia Tacker, Band Weaving, Van Nostrand Reinhold, New York 1974.

Candace Crockett, Cardweaving, Watson-Guptil, New York 1973.

